Study of the $NdO_{1.5}$-TiO_2-ZrO_2 ternary system of potential matrices for the immobilization of actinide wastes

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One of the defining issues in the nuclear industry's long-term development is the long-term storage of high-level waste (HLW). Preserving matrices with a complex of unique physicomechanical and chemical properties should be used to immobilization HLW. Currently, aluminophosphate and borosilicate glasses are uмsed as such matrices. Their disadvantages are low capacity for waste (4–15 wt.%), High solubility in water, rapid crystallization, deterioration of protective properties over time. It is proposed to use crystal matrices as an alternative to glasses. The study of the ternary system $NdO_{1.5}$-TiO_2-ZrO_2 is necessary to predict the compositions of ceramics promising as matrices for the rare-earth-actinide fraction of high-level waste (HLW). By solid-phase synthesis by sintering in a muffle furnace, 6 samples were obtained with a percentage along the line of 60 wt% NdO1.5 with variable compositions of TiO_2-ZrO_2, and 6 samples with a percentage along the line of 35 wt% NdO1.5 with a variable composition of TiO_2-ZrO_2, at temperatures of 1450 ^{0}C and 1500 ^{0}C.

The X-ray phase analysis was carried out on an Empyrean Malvern Panalytical X-ray powder diffractometer (CuKα, 40 kV, 20 mA, 0.02 ° step), a JSM_5610LV scanning electron microscope with a ULTIM MAX 100 energy dispersive spectrometer (SEM / EDS). The phase structure was determined by comparing the experimental X-ray diffraction patterns with the standards from the database. X-ray phase analysis of the samples showed that at a temperature of 1450 ^{0}C for six samples with 60 wt% NdO1.5 with variable TiO_2-ZrO_2 compositions, the formation of phases does not occur completely and require higher temperatures, and on the 35 wt% NdO1.5 13 % ZrO_2 line and 52 % TiO_2 is assumed to form a eutectic region. A preliminary SEM analysis confirmed this. More detailed results of the analysis of samples will be shown on the stand.

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Keywords: immobilization of high-level waste, crystal structures, X-ray phase analysis